beef-tea or Liebig's extract, and lastly, xanthine can be obtained from guanine, so that it seems not improbable that the manufacture of caffeine for medicinal purposes from Peruvian guano may be looked for as a consequence of the researches already made on the chemistry of these substances.

EUCLID REVISED

Euclid Revised, containing the Essentials of the Elements of Plane Geometry as given by Euclid in his First Six Books, with numerous Additional Propositions and Exercises. Edited by R. C. J. Nixon, M.A., formerly Scholar of St. Peter's College, Cambridge. (Oxford: Clarendon Press, 1886.)

THE movement for greater freedom in the teaching of elementary geometry than is consistent with a rigid adherence to Euclid's Elements, which may be regarded as having taken definite shape with the formation of the Association for the Improvement of Geometrical Teaching in the year 1871, gains strength surely, if not rapidly. Of this Mr. Nixon's book is one of many indications, notwithstanding his decision in favour of retaining Euclid's Elements as the basis of geometry. For this decision he assigns "*two* substantial reasons of expediency and convenience:—

"(1) That an established *order* of geometric proof is convenient for examination purposes;

"(2) A recognised *numbering* of fundamental results is convenient for reference."

He adds, "as co-operative reasons—the fact that there is no consensus of opinion among experts as to the superiority of any other scheme yet proposed; and the sentiment of repugnance at the thought of sweeping away an institution rendered venerable by the usage of more than 2000 years."

It may be questioned whether Mr. Nixon's first reason "of expediency and convenience" leads as a consequence to the retention of Euclid as a class-book. The experience of the examinations of the University of London is held by many examiners as well as teachers to prove the contrary. But apart from this we would enter our protest against the subordination here, as so often elsewhere, assumed of teaching to examination, of teachers to examiners. Examiners are doubtless strong, but teachers, if they will only combine and assert their convictions in practice, are stronger. We believe too that those who have most carefully considered the question of a rival order of sequence of geometrical propositions would agree that the best order in a logical arrangement does not seriously *conflict* with Euclid's order, except by simplifying it. Rather, by bringing the proofs of each proposition nearer to the fundamental axioms and definitions than Euclid does, it renders less assumption of previous propositions necessary for the proof of any given proposition. It stretches the chain of argument straight instead of carrying it round one or many unnecessary pegs.

Many instances of this may be found in Mr. Nixon's own book. To mention one only—the proof which he judiciously gives of the fundamental proposition that "similar triangles are to one another in the duplicate ratio of their homologous sides" depends directly on the 1st Proposition only of the Sixth Book, instead of the chain being carried round the unnecessary peg of the 15th Proposition, as it is by Euclid himself.

Waiving, however, farther discussion of these general considerations, and granting Mr. Nixon his postulates of expediency and sentiment without farther cavil, we have no hesitation in thanking him for having produced a good and useful book. The conditions under which he has worked are such as to make it unsatisfactory to one who seeks for a natural and symmetrical sequence and grouping of propositions forming a well compacted whole, but all the materials are there for enabling the student, if he has sufficient patience, to make it for himself. The book is well furnished with important propositions not contained in the ordinary editions of Euclid, but various excrescences in the shape of addenda and lemmas have been necessary to accommodate them, and in these addenda those which are of real importance for after use are rather hidden amid a crowd of other consequences, interesting as results, but not necessary parts of the geometrical edifice.

Mr. Nixon has, wisely as we think, distributed his axioms and definitions among the propositions, introducing each one exactly when it is required, instead of commencing with the full series, but it seems to us a serious defect that they are neither numbered nor anywhere collected together for reference. We are rather surprised that he has not taken the opportunity of revising Euclid's editors, and reverting to Euclid's division, into common notions and postulates, of what modern editions call the axioms and postulates; the common notions embracing those general axioms which are true for all magnitudes, while the postulates relate to geometrical magnitudes only and are the really essential basis of geometry.

While retaining the order of Euclid's propositions, Mr. Nixon has very freely revised his demonstrations both in substance and in form. Where he has introduced new demonstrations, they are in all cases, we believe, improvements. The famous *pons* disappears in favour of a proof founded on turning the triangle about one of its equal sides till it falls again into its original plane. Philo's proof of i. 8 is adopted, and consequently i. 7 omitted as useless. In Book II. the diagonals of the rectangles disappear. Euclid's propositions about the correspondence of equal chords, arcs, and angles at the centre of a circle are proved directly by superposition, as recommended in the Syllabus of the Geometrical Association, to which here as elsewhere Mr. Nixon acknowledges his indebtedness, but he still retains the propositions about similar segments which we should have expected him to omit (as in the case of i. 7), as thereby rendered useless. Book V. contains the essentials of the theory of proportion, deduced from Euclid's definition, in the form first suggested by De Morgan. In Book VI. superposition is often employed, where Euclid makes a separate construction, but not invariably, as, we think, might have been done with advantage.

We are less satisfied with the form of Mr. Nixon's demonstrations than with their substance. He objects strongly to Euclid's "prolixity," of which he goes so far as to say, after twenty years' experience as a teacher, that "NOTHING is so great a hindrance to the learner." We doubt this, speaking also not without experience. In

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some respects Euclid's prolixity, recalling over and over again propositions which have gone before, does much to fix them in the memory of the learner and prevent looseness in reasoning, and though we think Euclid's style admits with advantage of some pruning, we feel that Mr. Nixon, with overstrained regard to the examination hall, has used the knife too freely, and has run the risk by his style and free use of abbreviations and signs of letting the young pupil believe, as he is only too glad and ready to do, that mathematical work should be written after the fashion of a telegram, grammar disregarded, articles and little words omitted, and what should be sentences written without verb or copula.

Mr. Nixon has deliberately omitted the usual marginal references, on the ground that "learners (1) very generally ignore them; and (2) will gain greater benefit by having to hunt up the references themselves." We believe he has thereby seriously injured the value of his book. Because many boys, in the hands of a careless teacher and left to themselves, ignore the references, is hardly a good reason why they should not be supplied for those who would use them, or who would be required by their teacher to use them; and they would be exceptional pupils under exceptional teachers who could be depended on, or find it easy, "to hunt up the references themselves." Doubtless the exercise of doing this is excellent, but the beginner needs some help in doing it.

We have thought it would be most useful to dwell at some length on Mr. Nixon's revision of Euclid's text, and can only notice generally the exercises and addenda, which occupy more than half the book. The collection of exercises appears to be very well chosen and complete, though we should have been glad to see more of them interspersed among the propositions from which they naturally flow.

The addenda include all the more important developments of the elementary geometry, as well as an introduction to many of the methods of the higher geometry. As a collection of results in the geometry of the straight line and circle this part of the book appears to us from a cursory perusal to be excellent, giving a full account of the important relations of the triangle and its associated circles, centres of similitude, coaxial circles, &c.; while for methods the elementary notions and use of cross ratios, harmonic ranges, inversion, poles and polars are explained and applied to such an extent as to prepare the student naturally for their application to geometry beyond that of the straight line and circle. We fail, however, to find such prominence given to the great principles of duality and reciprocity as their importance, scarcely less in elementary than in the higher geometry, appears to us to demand.

The typography, and the accuracy and clearness of the figures, are to be commended as worthy of the Clarendon Press.

R. B. H.

OUR BOOK SHELF

Practical Histology and Pathology. By Heneage Gibbes, M.D. Third Edition. (London: H. K. Lewis, 1885.)

THE text in this edition does not, on the whole, differ much from that of the previous editions, some new useful formulæ of staining and a more comprehensive arrangement of the subject-matter being the chief differences.

The tables given at the end of the book as to the conversion of degrees of Centigrade into Fahrenheit and *vice versâ*, as to the conversion of English weights and measures into French, are in some points incorrect, and might have been easily correctly copied from any standard work.

E. KLEIN

Farm Live-Stock of Great Britain. By Robert Wallace, F.C.S. F.H.A.S., &c., Professor of Agriculture and Rural Economy in the University of Edinburgh. (London: Simpkin, Marshall, and Co.; Edinburgh: Oliver and Boyd, 1885.)

WITHIN 200 pages octavo, of rather large type, does Prof. Wallace condense much useful information upon farm live-stock. It must, however, be evident that to treat of cattle, sheep, swine, and horses, from a biological, an agricultural, and an economical point of view would at least require double the number of pages, containing twice the number of words, and folded quarto. Brevity has been said to be the soul of wit; but in a work such as this we cannot but feel that it must be intended by its author either for those who know nothing or for those who know something of the subject. It appears to us to fall short of the requirements of each of these classes of readers. Four and a half lines—forty words, in fact—upon the Devon breed of cattle cannot be considered adequate, however terse and compressed they may be (and to the point they undoubtedly are), to giving a good word-picture of this race. Besides, Prof. Wallace must excuse us for differing from him as to his statements even in this very short description. He is wrong in saying "colour blood-red, no white." There is white upon the fore-udder in almost all Devon cattle, and it is unfortunate that there should be a manifest error in this very short description of an important breed.

The book aims at too much, and is too vague in its general plan. The writer is successful in being concise, but he is not free from errors, and a greater amplitude in his observations would have both conferred a greater general interest upon his pages, and been more satisfactory to an earnest student of agriculture. Let us hope shortly to see an enlarged edition.

Common-Sense Euclid. Books I. and II. Part I. By the Rev. A. D. Capel, M.A., St. John's College, Cambridge. (London: Joseph Hughes, 1886.)

THE object of this book, as the author tell us, is to point out, especially to teachers and those teaching themselves, the portions of the treatise which either present difficulties to the beginner or escape their notice altogether.

The propositions are explained in a very clear and concise way, some of them being even worked backwards and their analysis being made in every case; explanations are given, here and there, where they are most required, and are put in the easiest possible way. Problems, at the end of each proposition and also at the end of the book, are given, making a total of 300, followed by hints for their solution.

The figures are not placed opposite each proposition, as they are in most editions, but all together at the end. The plan adopted is a very good one, it being understood that the student must construct the figures for himself.

J.

Arithmetic for Schools. By the Rev. J. B. Lock, M.A. (London: Macmillan and Co., 1886.)

THIS is a carefully prepared school-book, forming, as to scope, a sort of arithmetic mean between Hamblin Smith's and Brook Smith's or Muir's. It contains the usual rivulets of text ending in seas of examples. In the purely arithmetical part of the book logical accuracy is attempted with considerable success. Want of grasp is much more evident in the part which deals with the applications. There the division into subjects is strangely illogical, and

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